

Egypt

Renewables Report

Includes 10-year forecasts to 2028



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Key View

Key View: We have adjusted our power sector forecasts downwards slightly this quarter, owing to updated recent historical data, which indicates lower electricity demand than expected. This data is also likely to reduce the government's impetus to progress with some of the larger, more expensive projects currently in the early stages of development. Our renewables sector forecasts have not escaped this move to a more conservative outlook. We now anticipate non-hydropower generation to rise from 3.24TWh in 2018 to 4.95TWh in 2019 and 17.4TWh in 2028. Previously, we had projected that generation would reach 18.3TWh in 2027. The dominance of wind power within the renewables sector will wane somewhat, from 86.2% of non hydro renewables generation in 2019 to 64.9% in 2028, as the solar sector gains traction.

RENEWABLES HEADLINE FORECASTS (EGYPT 2018-2023)

Indicator	2018e	2019f	2020f	2021f	2022f	2023f
Generation, Non-Hydropower Renewables, TWh	3.244	4.949	6.484	8.109	9.758	10.658
Generation, Non-Hydropower Renewables, % y-o-y	45.0	52.6	31.0	25.0	20.3	9.2
Capacity, Non-Hydroelectric Renewables, MW	1,833.0	2,468.1	3,367.1	4,191.2	5,105.4	5,770.6
Capacity, Non-Hydroelectric Renewables, % y-o-y	111.7	34.6	36.4	24.5	21.8	13.0

Source: National sources, Fitch Solutions

Latest Updates And Structural Trends

- Voltaia** started construction of the 32MW Râ Solar photovoltaic (PV) plant in Egypt (November 2018). The facility is located in the Ben Ban complex in Aswan, Egypt. The solar farm will have 93,150 units of PV panels from Wuxi Suntech Power Co, each with a capacity of 345Wp, mounted on single-axis trackers. The facility has a 25-year power-purchase agreement with state-run **Egyptian Electricity Transmission Company**. The PV plant is scheduled to be commissioned in H219, according to a press release from Voltaia.
- Egypt's Ministry of Electricity and Renewable Energy held discussions with firms to carry out wind schemes with a total capacity of up to 1.8GW (August 2018). Investors will build and finance the wind projects and the electricity ministry will buy the output. The projects will require an investment of nearly EUR2bn (USD2.33bn) and will be implemented on build, own and operate model. The wind schemes include setting up a 600MW facility under an independent power producer scheme in collaboration with **Elsewedy Electric** and a 500MW plant for which discussions are underway with a European firm. The ministry is also negotiating with **Siemens Gamesa** for a 120MW plant and a Saudi Arabian firm for another 120MW wind farm. Another 460MW of wind capacity will be offered to international and local firms. Egypt plans to generate 20% of its total power from renewable sources by 2022 (Mubasher).
- Orascom Construction**, in a consortium with **ENGIE** and **Toyota Tsusho Corporation/Eurus Energy Holdings**, signed an agreement to officially start development on a new 500MW capacity wind farm in Ras Ghareb, Egypt (July 2018). The project will be developed on a build, own and operate model. The agreement was signed with the off-taker Egyptian Electricity Transmission Company and the New & Renewable Energy Authority, which is the landowner. The required steps and documentation for the start of the construction, including financial close, are expected to be completed by Q319 or Q419. The project complements the consortium's under construction 250MW wind farm, which is expected to be commissioned in H219, according to Orascom press release.
- French-firm **Voltaia** plans to add 800MW of renewable capacity in Egypt in the next five to eight years (July 2018). The firm will reportedly invest USD700-800mn to build solar plants with a capacity of up to 300MW and wind farms with an aggregate capacity of 500MW. The renewables firm has agreed with various French banks to fund the projects. It plans to expand the development of solar and wind stations in West Nile and Gulf of Suez. It has also contracted with Egyptian Electricity Transmission Company and the New and Renewable Energy Authority for a 25MW solar project within the feed-in-tariff projects in Benban, Aswan, according to Daily News Egypt. Voltaia has opened an office in Cairo to manage its Egyptian projects.
- The **European Bank for Reconstruction and Development** (EBRD) is considering offering up to EUR200mn (USD240.6mn)

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in sovereign loans to Egypt to support grid expansion in the country (May 2018). The loan, to be provided to Egyptian Electricity Transmission Company, will support construction and modernisation of high-voltage substations. The substations are the 500kV El Sadat and 500kV Shibin el-Kawm in Monofeya Governorate, 500kV New Atfih in south Cairo, 500kV West Mallawy in Upper Egypt and 220kV Abo Talaat substation in Alexandria Governorate. The project will facilitate the integration of at least 450MW of renewable power into the national electricity system and reduce transmission losses, thereby offsetting more than 2mn tonnes of carbon dioxide emissions annually, according to the EBRD.

SWOT

Renewables SWOT

SWOT Analysis

Strengths

- Egypt has registered substantial progress in fast-tracking growth in the power sector, albeit largely in other sectors thus far.
- Power demand is set to increase significantly over the coming decade, translating into substantial opportunities for power project developers.
- A number of international developers are showing strong interest in the market.

Weaknesses

- Egypt has an ageing T&D segment which will present a bottleneck for the integration of intermittent wind and solar power.
- Egypt is faced with a shortage of foreign exchange and has recently been beset by a fiscal crisis.
- Erratic changes to the feed-in-tariff mechanisms' first phase will generate caution among investors looking to boost long-term exposure to the market.

Opportunities

- Government interest in developing big-ticket renewables projects - evident in a series of high profile MOUs and contracts
- Electricity price hikes and fuel subsidy cuts should improve the competitiveness of renewable energy.
- Egypt has great conditions for wind power - in particular by the Red Sea coast.

Threats

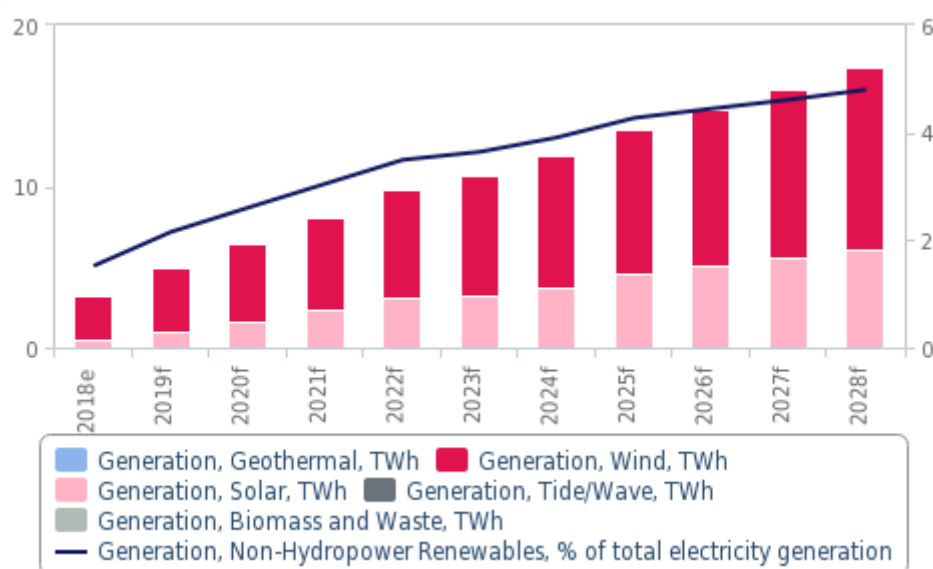
- Substantial devaluation of the Egyptian pound make the USD cost of renewables projects higher.
- Alterations to Egypt's solar feed-in-tariff mechanism risks offering too few incentives to attract investors to a challenging operating environment.
- High inflation and political opposition to requirements of IMF deal could bring political risks and instability back to the fore in Egypt.

Industry Forecast

Egypt Renewables Forecast Scenario

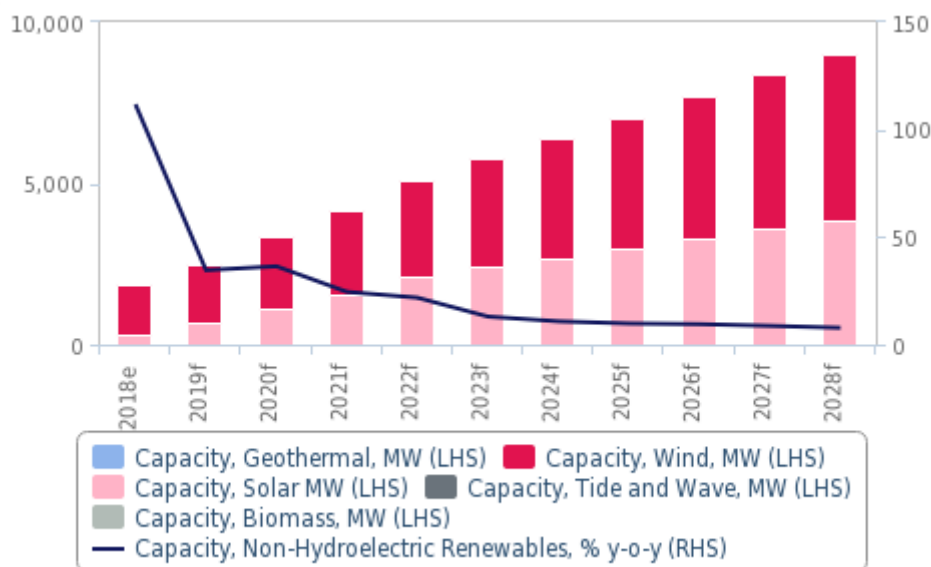
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Non-Hydro Renewables Generation By Type & Share Of Total Electricity Generation
(2018-2028)



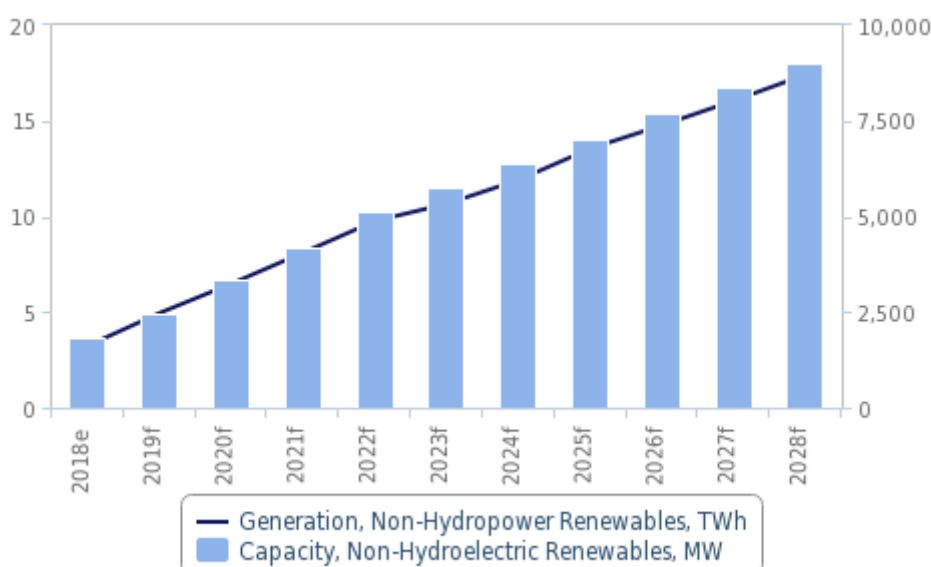
e/f = Fitch Solutions estimate/forecast. Source: EIA, Fitch Solutions

Non-Hydro Renewables Capacity By Type & Growth
(2018-2028)



e/f = Fitch Solutions estimate/forecast. Source: National sources, Fitch Solutions

Strong Gains Ahead
Non-Hydro Renewables Capacity & Generation (2018-2028)



e/f = Fitch Solutions estimate/forecast. Source: EIA, Fitch Solutions

TOTAL ELECTRICITY GENERATION DATA & FORECASTS (EGYPT 2017-2022)

Indicator	2017e	2018e	2019f	2020f	2021f	2022f
Generation, Total, TWh	194.849	213.391	230.085	249.159	266.065	279.438
Generation, Total, % y-o-y	7.735	9.516	7.823	8.290	6.785	5.026
Generation, Non-Hydropower Renewables, TWh	2.238	3.244	4.949	6.484	8.109	9.758
Generation, Non-Hydropower Renewables, % y-o-y	5.7	45.0	52.6	31.0	25.0	20.3
Generation, Non-Hydropower Renewables, % of total electricity generation	1.149	1.520	2.151	2.603	3.048	3.492

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Indicator	2017e	2018e	2019f	2020f	2021f	2022f
Generation, Geothermal, TWh	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Geothermal as % of total non-hydropower renewables generation	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Wind, TWh	2.067	2.795	3.982	4.857	5.716	6.600
Generation, Wind, % y-o-y	2.500	35.230	42.457	21.984	17.684	15.464
Generation, Wind, % of total non-hydropower renewables generation	92.362	86.157	80.453	74.906	70.496	67.638
Generation, Solar, TWh	0.171	0.449	0.967	1.627	2.392	3.158
Generation, Solar, % y-o-y	70.596	162.752	115.422	68.197	47.020	32.000
Generation, Solar, % of total non-hydropower renewables generation	7.638	13.843	19.547	25.094	29.504	32.362
Generation, Tide/Wave, TWh	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Tide/Wave, % of non-hydropower renewables generation	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Biomass and Waste, TWh	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Biomass and Waste, % of non-hydropower renewables generation	0.000	0.000	0.000	0.000	0.000	0.000

e/f = Fitch Solutions estimate/forecast. Source: National sources, Fitch Solutions

TOTAL ELECTRICITY GENERATION DATA & FORECASTS (EGYPT 2023-2028)

Indicator	2023f	2024f	2025f	2026f	2027f	2028f
Generation, Total, TWh	292.762	304.552	317.115	332.147	348.188	363.039
Generation, Total, % y-o-y	4.768	4.027	4.125	4.740	4.829	4.265
Generation, Non-Hydropower Renewables, TWh	10.658	11.905	13.547	14.764	16.051	17.414
Generation, Non-Hydropower Renewables, % y-o-y	9.2	11.7	13.8	9.0	8.7	8.5
Generation, Non-Hydropower Renewables, % of total electricity generation	3.641	3.909	4.272	4.445	4.610	4.797
Generation, Geothermal, TWh	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Geothermal as % of total non-hydropower renewables generation	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Wind, TWh	7.428	8.207	8.949	9.684	10.463	11.295
Generation, Wind, % y-o-y	12.549	10.479	9.046	8.210	8.047	7.947
Generation, Wind, % of total non-hydropower renewables generation	69.698	68.937	66.063	65.592	65.187	64.862
Generation, Solar, TWh	3.230	3.698	4.597	5.080	5.588	6.119
Generation, Solar, % y-o-y	2.273	14.500	24.320	10.500	10.000	9.500
Generation, Solar, % of total non-hydropower renewables generation	30.302	31.063	33.937	34.408	34.813	35.138
Generation, Tide/Wave, TWh	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Tide/Wave, % of non-hydropower renewables generation	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Biomass and Waste, TWh	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Biomass and Waste, % of non-hydropower renewables generation	0.000	0.000	0.000	0.000	0.000	0.000

f = Fitch Solutions forecast. Source: National sources, Fitch Solutions

ELECTRICITY GENERATING CAPACITY DATA & FORECASTS (EGYPT 2017-2022)

Indicator	2017e	2018e	2019f	2020f	2021f	2022f
Capacity, Net, MW	49,298.9	59,897.9	62,483.0	64,456.0	66,735.4	69,021.7
Capacity, Net, % y-o-y	13.7	21.5	4.3	3.2	3.5	3.4
Capacity, Non-Hydroelectric Renewables, MW	866.0	1,833.0	2,468.1	3,367.1	4,191.2	5,105.4
Capacity, Non-Hydroelectric Renewables, % y-o-y	5.9	111.7	34.6	36.4	24.5	21.8
Capacity, Non-Hydroelectric Renewables, % of total capacity	1.8	3.1	4.0	5.2	6.3	7.4
Capacity, Geothermal, MW	0.0	0.0	0.0	0.0	0.0	0.0
Capacity, Geothermal, % of total non-hydroelectric renewables capacity	0.0	0.0	0.0	0.0	0.0	0.0
Capacity, Wind, MW	750.0	1,530.0	1,815.4	2,269.2	2,632.3	3,000.8
Capacity, Wind, % y-o-y	0.0	104.0	18.7	25.0	16.0	14.0
Capacity, Wind, % of total non-hydroelectric renewables capacity	86.6	83.5	73.6	67.4	62.8	58.8
Capacity, Solar MW	116.0	303.0	652.7	1,097.9	1,559.0	2,104.6
Capacity, Solar, % y-o-y	70.6	161.2	115.4	68.2	42.0	35.0
Capacity, Solar, % of total non-hydroelectric renewables capacity	13.4	16.5	26.4	32.6	37.2	41.2
Capacity, Tide and Wave, MW	0.0	0.0	0.0	0.0	0.0	0.0
Capacity, Tide and Wave, % of total non-hydroelectric renewables capacity	0.0	0.0	0.0	0.0	0.0	0.0
Capacity, Biomass, MW	0.0	0.0	0.0	0.0	0.0	0.0
Capacity, Biomass, % of total non-hydroelectric renewables capacity	0.0	0.0	0.0	0.0	0.0	0.0

e/f = Fitch Solutions estimate/forecast. Source: National sources, Fitch Solutions

ELECTRICITY GENERATING CAPACITY DATA & FORECASTS (EGYPT 2023-2028)

Indicator	2023f	2024f	2025f	2026f	2027f	2028f
Capacity, Net, MW	70,907.6	72,902.5	75,059.1	77,418.1	79,955.7	82,672.4
Capacity, Net, % y-o-y	2.7	2.8	3.0	3.1	3.3	3.4
Capacity, Non-Hydroelectric Renewables, MW	5,770.6	6,395.9	7,025.5	7,690.7	8,356.5	9,011.8
Capacity, Non-Hydroelectric Renewables, % y-o-y	13.0	10.8	9.8	9.5	8.7	7.8
Capacity, Non-Hydroelectric Renewables, % of total capacity	8.1	8.8	9.4	9.9	10.5	10.9
Capacity, Geothermal, MW	0.0	0.0	0.0	0.0	0.0	0.0
Capacity, Geothermal, % of total non-hydroelectric renewables capacity	0.0	0.0	0.0	0.0	0.0	0.0
Capacity, Wind, MW	3,360.9	3,697.0	4,029.7	4,380.3	4,748.2	5,132.8
Capacity, Wind, % y-o-y	12.0	10.0	9.0	8.7	8.4	8.1
Capacity, Wind, % of total non-hydroelectric renewables capacity	58.2	57.8	57.4	57.0	56.8	57.0
Capacity, Solar MW	2,409.8	2,698.9	2,995.8	3,310.4	3,608.3	3,878.9
Capacity, Solar, % y-o-y	14.5	12.0	11.0	10.5	9.0	7.5
Capacity, Solar, % of total non-hydroelectric renewables capacity	41.8	42.2	42.6	43.0	43.2	43.0
Capacity, Tide and Wave, MW	0.0	0.0	0.0	0.0	0.0	0.0
Capacity, Tide and Wave, % of total non-hydroelectric renewables capacity	0.0	0.0	0.0	0.0	0.0	0.0
Capacity, Biomass, MW	0.0	0.0	0.0	0.0	0.0	0.0
Capacity, Biomass, % of total non-hydroelectric renewables capacity	0.0	0.0	0.0	0.0	0.0	0.0

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Egypt Renewables Projects Database

EGYPT - TOP 10 RENEWABLES PROJECTS BY CAPACITY

Project Name	Capacity (MW)	Status	Renewables Companies
Vestas Wind Farm Project, West Nile Region	2,200	Contract awarded	Vestas Wind Systems [Construction] {Denmark}, Eksport Kredit Fonden (EKF) [Financier] {Denmark}, Euler Hermes [Financier] {France}, HSBC [Financier] {United Kingdom}, Egypt Ministry of Electricity [Sponsor] {Egypt}
16 Solar photovoltaic units, Benban, Upper Egypt	1,800	Work underway (April 2018)	Infinity Solar Energy; ib vogt; Acconia Energia; Alfa Solar
Elsowedy - Gebel El-Zeit Wind Complex, Red Sea Governorate	580	Opened (July 2018)	Elsowedy Electric [Operator] {Egypt}
West Nile Area Wind Farm Project	250	Contract awarded	Egyptian Electricity Transmission Company (EETC) [Sponsor] {Egypt}
Lekela - Gabal Elzeit Wind Power Plant	250	Completed/ inaugurated (Nov 2015)	Mainstream Renewable Power [Operator] (40) {Ireland}, Actis Capital [Operator] (60) {United Kingdom}, Egyptian Electricity Transmission Company (EETC) [Sponsor] {Egypt}
Gabal Elzeit Wind Farm 4, Gulf of Suez	250	Contract signed (March 2018)	Engie [Operator] {France}, Toyota [Operator] {Japan}, Orascom [Operator] {Egypt}, Egypt's New & Renewable Energy Authority (NREA) [Sponsor] {Egypt}
Photovoltaic Solar Project, West Nile Area	200	In tender/Tender launched (January 2018)	Egyptian Electricity Transmission Company (EETC) [Sponsor] {Egypt}

Source: Fitch Solutions's Key Renewables Projects Database

Renewables Glossary

	Definition		Definition
bn	billion	IPO	initial public offering
capex	capital expenditure	IPP	independent power producer
CEE	Central and Eastern Europe	km	kilometres
CHP	combined heat and power plants	kW	kilowatt (10 ³ watts)
DoE	US Department of Energy	kWh	kilowatt hour
e/f	estimate/forecast	LNG	liquefied natural gas
EBRD	European Bank for Reconstruction and Development	MEA	Middle East and Africa
EIA	US Energy Information Administration	mn	million
EM	emerging markets	MoU	memorandum of understanding
EU ETS	European Union Emissions Trading System	MW	megawatt (electric) (10 ⁶ watts)
EU	European Union	MWh	megawatt hour
EWEA	European Wind Energy Association	na	not available/applicable
FDI	foreign direct investment	NGL	natural gas liquids
FIT	feed-in tariff	OECD	Organisation for Economic Co-operation and Development
FTA	free trade agreement	OPEC	Organization of the Petroleum Exporting Countries
GDP	gross domestic product	PV	solar photovoltaics
GHG	greenhouse gas	RES	renewable energy sources
GW	gigawatt (10 ⁹ watts)	R&D	research and development
GWh	Gigawatt hour (1 GWh = 3.6 TJ)	t	metric ton = tonne (1 t = 1,000 kg)
GWEC	Global Wind Energy Council	TPES	total primary energy supply
IAEA	International Atomic Energy Agency	trn	trillion
IEA	International Energy Agency	TW	terawatt (10 ¹² watts)
IMF	International Monetary Fund	TWh	terawatt hour (1 TWh = 3.6 PJ)

Renewables Methodology

Industry Forecast Methodology

Fitch Solutions' industry forecasts are generated using the best-practice techniques of time-series modelling and causal/econometric modelling. The precise form of model we use varies from industry to industry, in each case being determined, as per standard practice, by the prevailing features of the industry data being examined.

Common to our analysis of every industry is the use of vector autoregressions. Vector autoregressions allow us to forecast a variable using more than the variable's own history as explanatory information. For example, when forecasting oil prices we can include information about oil consumption, supply and capacity.

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When forecasting for some of our industry sub-component variables, however, using a variable's own history is often the most desirable method of analysis. Such single-variable analysis is called univariate modelling. We use the most common and versatile form of univariate models: the autoregressive moving average model (ARMA).

In some cases, ARMA techniques are inappropriate because there is insufficient historic data or data quality is poor. In such cases, we use either traditional decomposition methods or smoothing methods as a basis for analysis and forecasting.

Fitch Solutions mainly uses OLS estimators, and in order to avoid relying on subjective views and encourage the use of objective views **Fitch Solutions** uses a 'general-to-specific' method. **Fitch Solutions** mainly uses a linear model, but simple non-linear models, such as the log-linear model, are used when necessary. During periods of 'industry shock', for example poor weather conditions impeding agricultural output, dummy variables are used to determine the level of impact.

Effective forecasting depends on appropriately selected regression models. **Fitch Solutions** selects the best model according to various different criteria and tests, including but not exclusive to:

- R2 tests explanatory power; adjusted R2 takes degree of freedom into account;
- Testing the directional movement and magnitude of coefficients;
- Hypothesis testing to ensure coefficients are significant (normally t-test and/or P-value);
- All results are assessed to alleviate issues related to auto-correlation and multi-collinearity;

Fitch Solutions uses the selected best model to perform forecasting.

Human intervention plays a necessary and desirable role in all of **Fitch Solutions'** industry forecasting. Experience, expertise and knowledge of industry data and trends ensure analysts spot structural breaks, anomalous data, turning points and seasonal features where a purely mechanical forecasting process would not.

Sector-Specific Methodology

Generation Data

Total generation is defined as the process of producing electric energy or the amount of electric energy produced by transforming other forms of energy, commonly expressed in kilowatt hours (kWh) or related units. Gross electricity production is measured at the terminals of all alternator sets in a station, and thus includes the energy taken by station auxiliaries and losses in transformers that are considered integral parts of the station. Net electricity production is defined as gross production less own use by power plants. According to the International Energy Agency (IEA), the difference between gross and net production is generally about 7% for conventional thermal stations, 1% for hydro stations and 6% for nuclear.

Historical figures for electricity generation are based on data published in UN statistical databases and by the Energy Information Administration (EIA) and the World Bank, and consider net electricity production. Whenever possible, we compare these data with accounts published by government/ministry sources and official data of the companies operating in each country.

Fitch Solutions' electricity generation forecasts examine the sector with a bottom-up approach, forecasting electricity production for each resource in order to calculate the value of total generation. The regression model used to calculate generation considers real GDP, industrial production, fixed capital formation, population and fiscal expenditure.

Example of generation model:

$$\text{Generation} = \alpha + \beta_1 \text{ Real GDP} + \beta_2 \% \text{ industrial production} + \beta_3 \text{ fixed capital formation} + \beta_4 \text{ population} + \beta_5 \text{ fiscal expenditure} + u$$

Consumption and generation capacity are forecast using a similar regression model.

Capacity Data

Electricity generation capacity is defined as the maximum output, commonly expressed in megawatts (MW) or related units, that generating equipment can supply to system load, adjusted for ambient conditions.

Historical figures for electricity generation capacity are based on data published in the UN statistical databases and by the EIA. Whenever possible, we compare these data with accounts published by government/ministry sources and official data of the companies operating in each country.

Fitch Solutions' electricity generation capacity forecasts examine the sector with a bottom-up approach, forecasting capacity for each resource in order to calculate the total value of capacity in each country. **Fitch Solutions'** electricity generation capacity forecasts are based on a regression similar to the model illustrated above for electricity generation.

Sources

Fitch Solutions uses publicly available information to compile country reports and collate historical data. Sources used in power industry reports include those from international bodies mentioned above, such as the EIA, the World Bank and the UN, as well as local energy ministries, officially released company figures, national and international bodies and associations and news agencies.



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ISSN: 2399-2506

Copy Deadline: February 2019

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